

# Strategies to Eradicate Rubella in the English-Speaking Caribbean

## ABSTRACT

**Objective.** This report presents the strategies used to eradicate rubella in the Caribbean region and the challenges faced by that effort.

**Methods.** Using the surveillance system for measles cases that was instituted in all countries in the Caribbean Community (CARICOM), 12 countries confirmed cases of rubella between 1992 and 1996. Rubella infections occurred in epidemic proportions in 6 countries during that period.

**Results.** On the basis of the rubella prevalence data, rubella–congenital rubella syndrome (CRS) cost–benefit analysis, and cost-effectiveness of the mass campaign, the Council for Human and Social Development of CARICOM resolved, on April 21, 1998, that every effort would be made to eradicate rubella, as well as to prevent the occurrence of new cases of CRS by the end of 2000. Using the Pan American Health Organization's template for measles eradication, CARICOM proposed and implemented the main strategies for rubella and CRS eradication, and rubella mass campaigns were conducted in 18 countries. The target population, which included males and females (aged 20–40 years), was approximately 2.2 million.

**Conclusion.** The major challenges for rubella eradication are attaining high vaccine coverage in the adult population and maintaining an effective surveillance system able to detect rubella activity. (*Am J Public Health.* 2000;90:1545–1549)

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The smallpox eradication effort led by the World Health Organization in the 1960s and 1970s achieved in 1980 its goal of global eradication of this disabling disease.<sup>1</sup> This achievement spurred on public health practitioners and the scientific community to envisage the eradication of other diseases, such as poliomyelitis in the Americas by 1991 and worldwide by 2000<sup>2</sup> and measles in the Americas by 2000.<sup>3</sup>

The Caribbean Community (CARICOM), an institution consisting of heads of government and other ministerial councils, is the main forum for achieving consensus on regional issues and policies. In 1988, the ministers of health in CARICOM, which consists of 13 independent states and 6 United Kingdom Caribbean overseas territories together known as the English-speaking Caribbean and Suriname, resolved to eradicate indigenous cases of measles from their countries. These countries, with a combined population of around 6.7 million, are scattered over the Caribbean region, stretching more than 3500 kilometers from Bermuda in the north to the coast of Guyana and Suriname.

The strategy devised by the Pan American Health Organization (PAHO) for measles eradication<sup>3</sup> included the following: (1) a mass vaccination campaign (catch-up) targeting all children aged 9 months to 14 years; (2) improvement of surveillance systems for monitoring the progress of measles eradication; (3) maintenance of 95% measles vaccination coverage in each birth cohort through routine delivery services; and (4) follow-up measles campaigns to avoid an accumulation of susceptible individuals.

In May 1991, in response to a resolution of CARICOM, the first of the 4 proposals was implemented. Approximately 1.8 million children, representing 92.0% of the eligible target population, were vaccinated. The activities of this campaign also enhanced the measles coverage of the eligible birth cohorts in 1991. There was a net improvement of vaccination

coverage in these countries between 1991 and 1997 (Figure 1).

The Measles Eradication Surveillance System, an enhanced surveillance system for measles, was also instituted, making the English-speaking Caribbean and Suriname the first sub-region in the Americas to commit to and implement activities for measles eradication.

A total of 3286 suspected measles cases in 620 sites were identified from 1991 to 1997. Of these suspected cases, 3179 cases were discarded, including 81 cases of dengue and 620 cases of rubella. There were 107 confirmed cases of measles; 6 were laboratory-confirmed cases, and 107 were confirmed by clinical criteria without lab confirmation. The confirmed cases of measles were imported from North America and Europe, and there were no secondary cases.

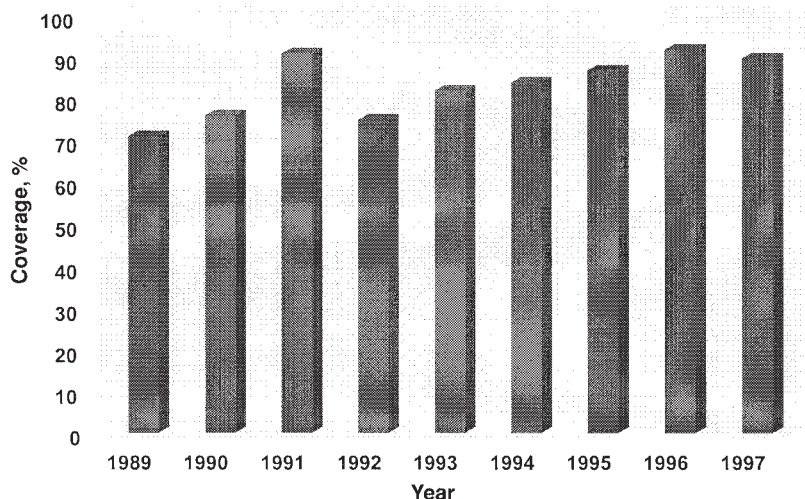
The 1991 measles vaccination campaign, in which a measles and rubella vaccine was used in 11 of the participating countries, was probably also to some degree responsible for the low rates of rubella—fewer than 2.0 cases per 100 000 people recorded annually between 1992 and 1995.

This report presents the strategies and challenges involved in the eradication of rubella.

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Source. Ministry of Health Reports to the 14th Caribbean Expanded Program on Immunization of the Caribbean Epidemiology Center.

**FIGURE 1—Measles and measles-mumps-rubella coverage in children 1 year of age in the English-speaking Caribbean and Suriname, 1989–1997.**

### Status of Rubella in the English-Speaking Caribbean

Significant epidemics of rubella have been documented in the Caribbean countries since the 1960s, with cases of congenital rubella syndrome (CRS) being diagnosed following such outbreaks. Grenada reported 648 cases of rubella in 1982, and Trinidad and Tobago reported 1159 cases in 1983. Twenty cases of CRS, including sudden deaths, were documented in Grenada between April 1982 and

June 1983.<sup>4</sup> Similarly, in Trinidad and Tobago, 20 neonates delivered at the Mt Hope Women's Hospital between November 1982 and July 1993 were diagnosed with CRS.<sup>5</sup>

Increased numbers of rubella notifications were also recorded in 1986, 1988, 1990, and 1996 (Figure 2). Beginning in 1995, renewed rubella activity was observed in Jamaica, where 81 cases of rubella were laboratory confirmed, for a national incidence rate of 3.3 cases per 100 000 people. In 1996, 672 cases of rubella were reported throughout the

region, for an incidence rate of 10.3 cases per 100 000 people. The greatest proportion of these cases was in Trinidad and Tobago (55.2%), whereas the highest incidence rates were recorded in Barbados and in Trinidad and Tobago, with 39.5 and 28.1 cases per 100 000 people, respectively. In 1997, 603 cases of rubella were reported, for an incidence rate of 9.2 cases per 100 000 people (Figure 2).

In 1997, the highest national incidence rate—30.4 cases per 100 000 people—was recorded in Belize. Significant rubella activity was first confirmed in Barbados in 1995, followed by Trinidad and Tobago in 1996 and Belize and Guyana in 1997.

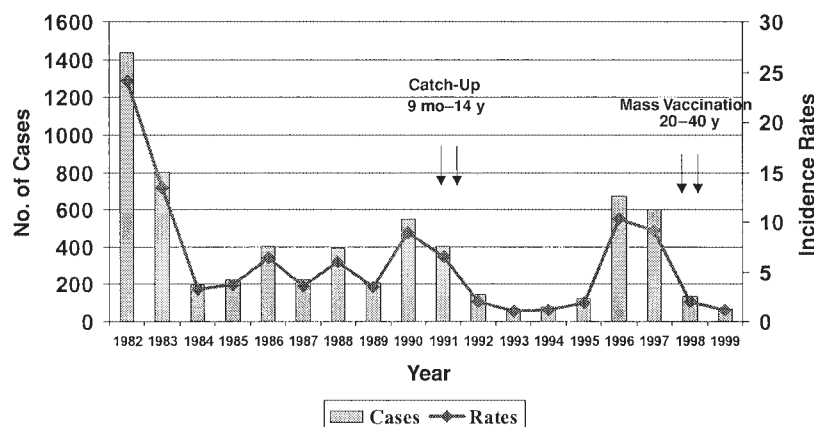
The age distribution of the rubella cases that were laboratory confirmed through the Measles Eradication Surveillance System revealed that 47.0% of the individuals were younger than 15 years and 53.0% were 15 years or older. The age groups with the highest incidence were 15 to 24 years in 1996 and 5 to 14 years in 1995 and 1997.

The male-to-female ratio was approximately 1:1. In Barbados, Jamaica, and Suriname, the male-to-female ratio was 2:1, reflecting the result of the prepubertal rubella program for girls in those countries, while in Belize and Guyana it was 1:2.

The public health burden of rubella is related to the risk of infection in pregnant women. The best method of identifying susceptibility to rubella in this population is through serologic surveys. In 1 survey in Jamaica in 1968, 43.0% of urban women and 51.0% of rural women were found to be susceptible to rubella.<sup>6</sup>

More recent studies conducted in Trinidad and Tobago (M.J. Lewis and G. Maynard, Ministry of Health, Trinidad and Tobago, unpublished data) in 1991 and 1992 indicated that 46.4% of a sample of 1838 pregnant women were negative for rubella antibody. In another serosurvey conducted in the British Virgin Islands (M.J. Lewis and I. Potter, Caribbean Epidemiology Center, unpublished data) in 1996 and 1997, 31.0% of pregnant women were found to be rubella seronegative at the time of their delivery. Pregnant women younger than 20 years in the British Virgin Islands were 7 times more likely to be immune from rubella than pregnant women 20 years and older.

The rubella antibody status of pregnant females, however, is at best a surrogate indicator of the potential risk of occurrence of CRS in a population, since measures of seroprevalence are not temporally related to incidence. Additionally, it is known that the actual risk of CRS is determined not only by rubella incidence rates among women of childbearing age but also by age-specific patterns of susceptibility and fertility.<sup>7</sup>



\* Rate/100 000 population

\*\* Preliminary data

Note. Rate is per 100 000 people. All data for 1999 are preliminary.

Source. The Caribbean Epidemiology Center of the Pan American Health Organization.

**FIGURE 2—Rubella cases and incidence rates in the English-speaking Caribbean and Suriname, 1982–1999.**

## ***Congenital Rubella Syndrome***

Rubella is a notifiable disease in 15 of the 19 countries of the English-speaking Caribbean and Suriname, and all 19 countries have been reporting cases to PAHO's Caribbean Epidemiology Center (CAREC) since the 1980s. In almost all countries of the region, however, CRS previously was not a notifiable disease and was not listed on the communicable disease registry at CAREC. In 1996, a multidisciplinary, interagency team developed a prototype surveillance system for CRS, including case definition, case investigation forms, and reporting algorithms, which was subsequently disseminated to the regional countries. Between 1996 and 1997, 31 cases of CRS were reported from Jamaica, Barbados, Trinidad and Tobago, Belize, Guyana, Bahamas, and Suriname, of which 28 were diagnosed in children 12 months or younger. The mothers who had babies with CRS ranged in age from 14 to 39 years, with most 20 years and older. The maternal age distribution of CRS cases supported the hypothesis that we have not as yet increased rubella vaccination coverage among women of childbearing age enough to prevent CRS. Our use of measles-mumps-rubella (MMR) vaccine has been too recent to demonstrate any significant benefit from infant vaccination strategies. Additionally, infection of these women represents significant missed opportunities for vaccination immediately postpartum or at postnatal visits, as many of these women were multiparous.

### ***Rubella/CRS Cost-Benefit Analysis***

CRS is associated with great morbidity, mortality, and economic expense. The direct costs associated with it can be categorized as (1) high care costs for physician and hospital services, (2) long-term care costs, (3) institutional care costs, and (4) special educational care costs.

In 1997, costing exercises were undertaken in some countries to assess the costs associated with care of individuals with CRS. In Guyana, an interview-based study of prevalent CRS cases estimated that the average lifetime cost of care per child with CRS, including indirect costs, was \$63 990 (all figures in US dollars). This study also assessed the total costs of the CRS burden in Guyana for the period 1992 to 1997 to be \$1.9 million (K. Kandola and M. Collins-Harris, unpublished data, 1997). The Jamaican Ministry of Health estimated that the direct costs associated with care of a child with CRS might be on the order of \$13 483 per annum (M. Robinson and H.

Chase, unpublished data, 1997). The Barbados Ministry of Health determined that the estimated lifetime cost of care per child with CRS was approximately \$50 000 (R. Kommu and H. Chase, unpublished data, 1997). It was also noted that in the absence of any additional vaccination initiatives, 105 CRS cases could potentially occur during the period 1997 through 2012, resulting in lifetime costs in excess of \$5.2 million, compared with a cost of \$1.1 million for an eradication initiative.<sup>8</sup>

In addition, the data generated by a costing exercise performed by each country's delegation to the 14th Caribbean Expanded Program on Immunization (EPI) Manager's Meeting in 1997 indicated that mass campaigns with a rubella-containing vaccine to eliminate rubella virus and CRS would be highly cost-effective in most Caribbean countries.

For the English-speaking Caribbean and Suriname, it was estimated that even with the present strategies now in place in some of the countries, a total of 1500 cases of CRS would occur over the next 15 years. During this time, the countries already using a rubella-containing vaccine would experience limited impact from their existing strategies. Expenditures for rehabilitation and care of patients in these cases, without counting the human suffering, were estimated at more than \$60 million for the same period. Implementation of the strategy to interrupt rubella transmission and to prevent the occurrence of CRS over this period would cost approximately \$4.5 million. The cost-effectiveness of the mass campaigns was estimated to average \$2900 per case of CRS prevented. The impact of congenital rubella infection is so devastating and costly that the governments of English-speaking Caribbean countries were encouraged by CAREC/PAHO, the health advisor to CAMICOM, and the countries' chief medical officers to opt for prevention and control.

### ***The CARICOM Initiative***

Since the implementation of the 1988 CARICOM resolution in May 1991, there have been no indigenous cases of measles in these countries, making this subregion the first to have implemented elimination activities. The measles elimination effort therefore provided the political and epidemiologic template for the proposal of rubella elimination.

Rubella and CRS have been clearly shown to constitute a major public health problem, with costly economic impact on the budgets of governments in the CARICOM countries. This vital information was presented to the Council for Human and Social Development of the Caribbean Community on April 21, 1998,

and the council consequently passed the following Resolution on Elimination of Rubella<sup>9</sup>:

Recognizing the importance of human resources to the continued development of the Caribbean community;

Conscious that rubella in pregnancy gives rise to miscarriage and stillbirths while congenital rubella syndrome gives rise to children with severe birth defects such as congenital heart disease, cataracts, deafness, mental retardation, and microcephaly;

Further conscious of the continued transmission of rubella resulting in cases of congenital rubella syndrome within the community with the concomitant costs for the care and rehabilitation of children with congenital rubella syndrome;

Aware that cost-benefit studies in several Caribbean countries clearly indicate that the investment in rubella elimination will bring tangible benefits within 5 years, given the high cost of care and rehabilitation of children with congenital rubella syndrome;

Noting that, should an eradication program not be implemented, there could be a substantial number of cases of congenital rubella syndrome over a 15-year period;

Further noting that the cost of the eradication program is estimated at 7% of the cost of providing care and rehabilitation for those cases;

Resolves that every effort will be made to eradicate rubella and prevent the occurrence of new cases of congenital rubella syndrome in the Caribbean Community by the end of the year 2000;

Urges PAHO to coordinate the mobilization of resources and technical support toward this end.

### ***The Strategy***

Two major vaccination strategies have been used in developed countries since 1969. The United States used mass vaccinations of children younger than 12 years followed by routine vaccinations of children after their first birthday. In the United Kingdom, the vaccination program targeted prepubertal girls and childbearing women.<sup>10</sup>

Rubella vaccine was introduced into some countries of the English-speaking Caribbean in the late 1970s and early 1980s, following the rubella epidemic of the late 1970s.<sup>11,12</sup> The vaccine was given mainly to prepubertal girls in at least 13 of the initial 19 countries, but the recorded coverage was less than 80%. The pool of susceptible individuals was still quite large,<sup>12</sup> although 14 of the countries had introduced a measles and rubella vaccine for each birth cohort before 1990.

The rubella eradication program was aided by the earlier measles eradication program and the use of MMR vaccine in the infant immunization schedule. With the PAHO template for measles eradication as a guide, similar strategies were proposed and implemented for rubella and CRS elimination.



## Results of Eradication Campaigns

### *Rubella Mass Campaigns*

In response to the emerging rubella situation and within the context of already-planned follow-up measles vaccination campaigns, the Bahamas conducted an MMR vaccination campaign in 1997, targeting the population aged 4 to 40 years. This campaign had 2 objectives: the follow-up measles campaign and reduction in the number of people susceptible to rubella infection, thereby interrupting the transmission of rubella virus.

The Bahamas presented us with our first experience of a rubella mass vaccination campaign, which was conducted from July to December 1997. Both males and females were targeted, because males, if not vaccinated, could sustain an epidemic. The target population totaled 153 180. The overall coverage rate was 67.4%; for children aged 4 to 14 years the coverage rate was 96%.

Rubella mass campaigns have so far been completed in 5 countries—Bahamas, Dominica, Trinidad and Tobago, Montserrat, and Guyana—with vaccination coverage ranging from 67% to 90%. Catching-up activities are still occurring in these countries. Campaign activities are in progress in 10 other countries (Anguilla, Antigua and Barbuda, Barbados, Belize, Grenada, Jamaica, Saint Kitts–Nevis, Saint Vincent, Suriname, and Turks and Caicos). These campaigns have targeted populations up to 40 years of age in some countries. The target population of approximately 2.2 million includes males and females. Because the measles catch-up campaign of 1991 achieved over 90% coverage in the targeted cohort, some countries felt that they should concentrate on an older age group; hence, the most frequent age grouping used was 20 to 40 years. Of the total target population of 2.2 million, 1 138 454 (52%) have already been vaccinated.

MMR vaccine (Schwarz strain of measles, Wistar RA-27/3M strain of rubella, Urabe strain of mumps) was used to vaccinate 892 074 people. Rubella vaccine was used in 1 country, measles–rubella vaccine in 3 countries, and MMR vaccine in 10 countries.

### *Safe Immunization Practices*

The guidelines for safe immunization practices that were used by health workers included information such as safe syringe and needle practices, adverse events registry and its management, and surveillance for needle injury. Single-use disposable syringes were and are being used for vaccinations. Commercial biohazard containers, plastic bottles, or cardboard boxes were used to collect used sharps and sy-

ringes, which were ultimately disposed of in most areas by incineration and in other areas by either burning or burying.

Accidental needle injuries were reported from only 1 country. No recapping of needles is the program's usual policy.

Surveillance and management of adverse events and other vaccine-related concerns were established; adverse events were minimal. The most reported event was parotitis ( $n=287$ ), which occurred mainly in adults; it accounted for 60% of the total reported events, with a rate of 32 reports per 100 000 persons vaccinated. The other reported events included fever, rash, pain, and redness at site of injection.

There were no case reports of anaphylactic reaction. However, there were 6 cases of an "allergic type reaction," which included fever, skin rash or wheals, and swollen hands, arms, and face; these occurred within 24 to 48 hours of vaccination.

One case of aseptic meningitis (a serious adverse event) has been identified so far. The symptoms and signs in this case were transitory and there were no sequelae.

### *Surveillance of Rubella and CRS*

Because information on rubella was obtained through the Measles Eradication Surveillance System, which identifies any fever-and-rash illness with laboratory testing, the Measles Eradication Surveillance System was capable of detecting the rubella virus. A working group consisting of 16 participants from 4 countries and 2 agencies (CAREC/PAHO and the US Centers for Disease Control and Prevention) developed guidelines for rubella and CRS surveillance, emphasizing case definition and laboratory procedures. They further recommended an integrated measles and rubella surveillance system (expansion of the present fever and rash illness surveillance system to provide information on rubella). The purpose of this surveillance is not necessarily to detect every case of rubella infection but to know when and where rubella virus is circulating.

The CRS surveillance system was refined to augment the rubella surveillance system. The primary purpose of CRS surveillance is to document the occurrence of the disease and to act as a complementary indicator of recent rubella virus circulation in the population. Additionally, the surveillance system should identify gaps in the rubella elimination strategy.

In 1998, the system confirmed 135 rubella cases (2 per 100 000 people), 124 of which were in countries that had not yet initiated vaccination activities; 90 of the cases were in Suriname. In 1999, 70 cases of rubella were confirmed. We have had no confirmed cases from those countries that have completed vaccination activities.

From 1997 to 1999, 33 CRS cases were confirmed; 9 CRS cases were reported in 1998 (3 in Bahamas, 1 in Belize, 2 in Guyana, 1 in Jamaica, and 2 in Trinidad and Tobago) and 2 in 1999 (both from Suriname).

## Future Challenges

The major challenge for rubella eradication in the English-speaking Caribbean and Suriname is to attain high vaccination coverage in the adult population. Those countries that have not yet done so plan to finish vaccinating by the end of 2000. Adverse effects should not be a barrier to vaccination, as experience gained so far with vaccination of adults has indicated that such effects are not severe.

As observed with the measles eradication program, importation will still remain the major threat for reemergence of measles or rubella cases. Workers in high-risk areas such as health and tourism have to be appropriately vaccinated.

A great part of the success of the combined measles–rubella surveillance system will derive from its use of the Measles Eradication Surveillance System, which has already been in place for years, allowing countries to institute the new system with minimal change. The mildness and short duration of the clinical signs and symptoms of rubella infection present difficulty for diagnosing and reporting the disease. Therefore, there will be challenges associated with clinical diagnostic accuracy and high incidence of nonapparent infection. Maintaining an effective surveillance system with the ability to detect rubella activity will be of paramount importance.

One challenge for the surveillance system is that CRS is a rare event, especially in nonepidemic periods.<sup>7</sup> The reported CRS cases between 1996 and 1998 represent only severe cases with multiple signs and symptoms. Unilateral deafness, a defect that commonly occurs alone, may not be detected in infancy. These infected infants may appear normal at birth. In general, CRS cases that result only in hearing deficiency or mental retardation, which manifest in the postneonatal period, may not be detected by a CRS surveillance system. However, the number of CRS cases with postneonatal manifestations may equal the number of CRS cases with defects detected in the neonatal period.<sup>12</sup> The CRS case surveillance system is limited to children aged up to 1 year and therefore will not detect most of the hearing defects.

The commitment and the active response of the regional governments, together with the technical direction, advice, and support of PAHO, have been key elements in the success of the initiative.

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## Contributors

B. Irons and M.J. Lewis analyzed the data and prepared the first draft. M. Regis-Dahl provided the analysis of the Bahamas program. C. Castillo-Solórzano and P.A. Carrasco reviewed the draft. C. A. de Quadros coordinated the implementation of the strategy and the preparation of the manuscript.

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